IDAHO POWER
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Inventory of Plant Species of Special Concern in the Hagerman Study Area

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Revised
Technical Report
Appendix E.3.3-B

Bliss
FERC No. 1975

Lower Salmon Falls
FERC No. 2061

Upper Salmon Falls
FERC No. 2777

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Abstract

Inventories for rare plants occurring in the vicinity of the Snake River, River Miles 589.2 to 552.9, in southwestern Idaho were conducted in 1990-1994. No federally recognized Threatened or Endangered species were found. Four species of rare plants listed by the Idaho Native Plant Society were found: ***Astragalus purshii*** Dougl. Ex Hook var. ***ophiogenes*** (Barneby) Barneby, ***Epipactis gigantea*** Dougl. Ex Hook, ***Eriogonum shockleyi*** var. ***shockleyi*** Rev. and ***Mentzelia torreyi*** Gray var. ***acerosa*** (M.E. Jones). ***Astragalus purshii*** var. ***ophiogenes*** is a federal candidate species (3C). Each species appears to occupy different habitats as characterized by vegetation cover type, hydrologic, topographic and edaphic factors.

Most species grew on sites that showed some degree of site disturbance. ***Astragalus purshii*** var. ***ophiogenes*** may be adapted to natural disturbance. Little information was available regarding the tolerance of the other four species to disturbance. Impacts to populations as a result of hydroelectric operations are unlikely for all species because the species are located in habitats unaffected directly by hydroelectric operations.

1. Introduction

Rare species protection formally began in the United States in 1966 with the congressional passage of the Endangered Species Preservation Act (Fish and Wildlife Reference Service Newsletter 1991). The law provided for listing of animal species native to the United States as Endangered. The Departments of Agriculture, Interior and Defense were encouraged to protect listed species and preserve appropriate habitats in a manner consistent with the primary land management objectives of each agency. Recognition of the need for global protection of rare animals was implemented with the passage of the Endangered Species Conservation Act of 1969. The act called for, and resulted in, an international meeting to develop standards for the worldwide trade of wildlife species. The subsequent agreement, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), was signed in early 1973. It restricted international commerce of animal and plant species believed to be negatively affected by trade. This recognition of the need to protect plant species was incorporated into the United States' rare species protection policy with the passage of the Endangered Species Act of 1973 (ESA). The ESA provided definitions for 'Endangered' and 'Threatened' categories, required all federal agencies to conserve globally and nationally rare species of animals, plants, and invertebrates and included language that prohibited those agencies and programs administered by them from taking actions that would adversely affect listed species and their habitats. The Act has been modified three times since original passage. As it stands today, the Act provides protection of rare plants, vertebrates and invertebrates when a species is threatened by extinction through 1) present or threatened destruction, modification or curtailment of its habitat or range; 2) over-utilization for commercial, recreational, scientific, or educational purposes; 3) disease, or predation; 4) inadequacy of existing regulatory mechanisms; and 5) other natural or manmade factors affecting its continued existence. There are now three categories of rare species recognized: Endangered, a species in imminent danger of extinction through all or a portion of its range; Threatened, a species likely to become Endangered in the foreseeable future; and Candidate, a species thought to be rare, but requiring study to determine eligibility for Threatened or Endangered status. The term 'listed species' refers only to species formally recognized as having Threatened or Endangered status. Three subcategories of the Candidate status are recognized: C1, those species about which enough information is known to justify listing; C2, those species about which more information is needed to determine status; and 3C, those species about which enough information is known to warrant removal of the species from the Candidate list.

The Nature Conservancy (TNC) has established a nationwide network of state and privately operated computer databases that track the status of rare plants, invertebrates and vertebrates. While TNC uses the database to determine which species and habitats to target for acquisition or protection at the local and national level, many states have begun using the database to monitor rare species that occur within their boundaries.

Some states have begun to recognize and protect plant species that are rare within their political boundaries, but may not be rare elsewhere (e.g., California and Oregon). Locally rare populations can be the result of a political boundary located near the edge of a species' range, regional endemism, or disjunction. In Idaho, protection of plant species is the responsibility of the Idaho Transportation Department (ITD). **Idaho Code** §§ 18-3911 *et seq* (1972), provides for the protection of 19 plant species growing upon the right-of-way along any public highway in Idaho. Of the 19 species only two are currently recognized as rare in Idaho (INPS 1994). A second agency, the Idaho Department of Parks and Recreation (IDPR), has the responsibility for amending the list of species to be protected for scenic beauty or from extinction. Under the current law, except for the 19 species listed by **Idaho Code** §§ 18-3911 (1979) and the species recognized by the ESA, all rare plant protection in Idaho is voluntary.

A list of plant species thought to be rare in Idaho is administered by the Idaho Native Plant Society (INPS). Plant species are ranked by relative rarity and imminency of threat. Federal Candidate and listed species are included in the ranking (Appendix 1).

Because hydropower generation is regulated by the Federal Energy Regulatory Commission (FERC), all new license and relicense applications require information regarding federally listed species and candidates occurring in the vicinity of a hydroelectric project. This information includes plant locations, habitats and all potential and existing impacts to those species that may arise during project operations. Idaho Power Company (IPC) will file relicensing applications for the Upper Salmon Falls, Lower Salmon Falls, and Bliss hydroelectric projects in 1995. Documentation regarding vegetation that accompanies a relicense application must include 1) a description of existing plant communities occurring in the proposed project area and its vicinity, 2) a map of vegetation cover types, 3) identification of any species listed or proposed for listing by the U.S.Fish and Wildlife Service, 4) identification of impacts, if any, to vegetation as a result of project operation and 5) plans to mitigate for impacts (18 CFR Ch. I, Subpart E § 4.41 (1991)). This report describes rare botanical resources known to occur in the vicinity of Upper Salmon Falls, Lower Salmon Falls, and Bliss hydroelectric projects. The first objective was to identify uncommon plant associations that occur in the study area. The second objective was to identify factors which may influence the presence or absence of uncommon plant associations.

2. Study Site

2.1. Location

The Hagerman Study Area is located on the Snake River Plain in southwestern Idaho, near the communities of Hagerman and Bliss (Figure 1). It encompasses approximately 43 km of the Snake River and extends for 1.6 km on either side of the river bank. The elevation of the study area ranges from 762 to 1036 m above mean sea level incorporating a deeply incised basalt channel cut into the surrounding plain. Three hydroelectric projects fall within the study area, Upper Salmon Falls Dam (plants A & B; FERC No. 2777), Lower Salmon Falls Dam (FERC No. 2061), and Bliss Dam (FERC No. 1975) and the impoundments associated with each dam. Each project has a legally defined FERC project boundary incorporating physical structures and impoundments. All three projects are have limited storage capacity.

There are three unimpounded reaches present in the study area. The first is the Thousand Springs Reach, above Upper Salmon Falls Reservoir (RM 589.2-585.4), the second is the Wiley Reach, between Lower Salmon Falls Dam and Bliss Reservoir (RM 573.0-565.7) and the third is the Dike Reach, located immediately downstream of Bliss Reservoir (RM 560.0-552.9). Major tributaries to the Snake River include the Malad River, Salmon Falls Creek, Riley Creek, and Billingsley Creek. Additional significant inflows originate in the Thousand Springs complex from Niagara Springs (RM 600.8) to Owsley Bridge (RM 585.4).

2.2. Climate

The climate of the study area is semi-arid because of an orographic rain shadow created by the Cascade Mountain Range (Caldwell 1985, Franklin and Dyrness 1988, West 1988). Total precipitation per year averages 216 mm (9.6 in.) (NOAA, Bliss weather station, 1951-1980). Mean annual temperature averages 10.6° C (51.0° F). Summers are typically hot and dry. Average precipitation for the summer months is 7.9 mm (0.35 in.) and daytime temperatures regularly exceed 37.8 °C (100 °F) during July (NOAA, Bliss weather station, 1951-1980). Generally, precipitation that falls during the summer does not percolate into the soil beyond the surface layer (Caldwell 1985, West 1988), instead it is primarily lost through evaporation and runoff. Winters are typically cold and moist. Most of the precipitation falls during the winter months as snow (Figure 2). Snowmelt provides most of the stored moisture in the soil profile that is available to vegetation (Caldwell 1985, West 1988).

2.3. Vegetation

Presettlement vegetation specific to the Snake River corridor is poorly known. A handful of illustrations were made in the mid to late 1800's that clearly identify ***Artemisia tridentata*** as the dominant overstory species (Settle 1940, Fremont 1845). There have been numerous attempts to describe the botanical features of southwestern Idaho since the first recorded collecting trips made in the early and mid-1800's by John C. Fremont and John McLeod. Unfortunately, most collectors were less interested in describing plant communities than single species (D. Henderson, Univ. of Idaho, *pers. comm.*); thus historians are left with an incomplete picture of the historical organization of Idaho's vegetation landscapes.

Descriptions of pristine vegetation are based primarily upon existing conditions at sites that are thought to be undisturbed and from historic data collected elsewhere in the Intermountain Region of the northwestern United States. Taxonomy follows Kartesz and Kartesz (1980).

2.3.1. Upland Vegetation

The study area falls within the physiographic province identified as the Columbia-Snake River Plateau (West 1983*a*, 1988), known alternatively as the Intermountain Sagebrush Province (Bailey 1978). Upland areas have been classified by West (1983*b*) as part of the Western Intermountain Sagebrush Steppe. Some authors include the study area within the extent of the Great Basin flora (Hidy and Kleiforth 1990), although the area does not coincide topographically with the physiographic boundaries that define the Great Basin.

Artemisia species coupled with an understory of perennial bunchgrasses including ***Agropyron, Poa, Stipa*** and ***Oryzopsis*** species, are typical of sagebrush steppe. Once thought to be subclimax to perennial grassland communities (Shantz and Zon 1924, Weaver and Clements 1938, Clements and Clements 1939), sagebrush-grass vegetation is now thought to be ecologically stable. Local shifts in composition can occur rapidly and frequently in response to climatic conditions (Blaisdell 1958, Sharp et al. 1990) but overall composition and abundance have been shown to be stable (Anderson and Holte 1981).

Much of the sagebrush-bunchgrass vegetation has changed from pristine to disturbed condition since human occupation, beginning essentially with the adoption of horses by Native Americans (Yensen 1982). A number of factors have combined to cause a sometimes severe alteration of the natural ecological state, including grazing, agriculture, fire, and introduction of exotic species.

2.3.2. Riparian and Emergent Wetland Vegetation

Juxtaposed upon the dry landscape are narrow bands of riparian vegetation that follow perennial water courses. In this setting, trees and tall shrubs, such as ***Salix*** spp., replace the ***Artemisia*** spp. and the diversity of grasses and forbs increases (Mitsch and Gosselink 1993). Within the narrow band, numerous riparian communities are distributed along a moisture gradient from emergent wetland to vegetation transitional between wetland and upland communities (Myhre and Clements 1972, Jensen and Verhovek 1979, Tisdale 1986, Minshall et al. 1989, Johnson et al. 1992). Species are also distributed in response to local changes in soils, topography, and, at least historically, periodic disturbance, e.g., flooding (Mitsch and Gosselink 1993, Sather-Blair 1988).

Flooding is a natural ecological disturbance that greatly affects the composition and arrangement of species within the riparian corridor (Szaro 1989). Most riparian species are well adapted to periodic disturbance because of the dynamic nature of their natural environment. Flooding maintains riparian systems by creating new habitat, distributing nutrients, and importing and exporting organic material (Etherington 1983, Mitsch and Gosselink 1988). Seasonal flooding also maintains wetland and riparian habitats in early successional stages (Etherington 1983) leading to more species diversity than occurs in surrounding vegetation (Klimas 1988).

2.3.3. Rare Plant Species

In Idaho, 360 plant species are thought to be rare, including 69 species under consideration for inclusion on the Idaho Native Plant Society (INPS) Rare Plant List (INPS 1994*b*). Of the 360 species, 24 may occur in the vicinity of the Hagerman Study Area (Appendix 2). Most of the 24 species are perennials (67%). Most occupy upland habitats (92%), occurring primarily in ***Artemisia tridentata***-dominated communities and salt-desert shrub vegetation dominated by ***Atriplex*** or ***Sarcobatus*** species. Two are known from riparian settings. Over 60% are spring blooming. Only 20% are endemic to Idaho; often they are endemic varieties of more widely distributed species.

2.4. Land Use

In the 1860's ranchers grazed large herds of cattle in southern Idaho (Yensen 1982) to provide food for the growing population of miners (Young 1986). By the 1880's, large cattle ranches were common. Sheep herding also became more common about this time (Yensen 1982, Young 1986). An 1880 census reported 27,326 sheep in Idaho. In 1890, a census listed 357,712 sheep (Young 1986). The years 1889 and 1890 brought two of the coldest and snowiest years recorded. Unbearable weather conditions combined with a decade of severe overgrazing devastated herds of cattle and sheep. Subsequently, hay farming on irrigated land soon became a common practice to provide reliable winter food for cattle (Young 1986) and sheep (Yensen 1982). The Hagerman Valley surrounding Upper- and Lower Salmon Falls reservoirs was extensively used for irrigated agriculture for almost a century because of the availability of numerous springs along the north and east sides of the Snake River. Upland areas that were not irrigated were grazed by livestock.

Following the passage of the Carey and Desert Land Entry Acts, private organizations and the federal government rushed to build irrigation facilities to divert the flow of the Snake River and tributaries onto the desert landscape in order to "reclaim" the land for agriculture. Irrigation projects became common place and agriculture became an important source of income for the region (Miss and Campbell 1988).

In the late 1950's technology became available to build powerful electric pumps to irrigate upland habitats on the benches above the Snake River. Subsequently, large tracts of ***Artemisia***-dominated lands were developed for agriculture (Stacy 1991). Currently, much of the upland areas on the benches, as well as much of the Hagerman Valley are under cultivation. Nearly 500,000 acres of the surrounding counties have been converted to cropland (J. Grover, Consolidated Farm Service Agency, *pers. comm.*). This amounts to 20% and 25% of total land acreage in Gooding and Twin Falls counties, respectively. Uncultivated areas are generally grazed. The exception is the Hagerman Fossil Beds National Monument, which has not been grazed since the early 1980's.

3. Methods

A list of species that may occur within the study area and their habitats was compiled from the literature (e.g., DeBolt and Rosentreter 1988) and in consultation with CDC and BLM personnel. In addition, a list of Element Occurrence Records was obtained from the Idaho Conservation Data Center (CDC). The Element Occurrence Records included information on all reported occurrences of rare species in the Hagerman Study Area. The information is based on recent field reports submitted to the CDC and historic herbarium records from collections nationwide. A field manual with photographs, or technical illustrations, and written descriptions of plants and their habitats was provided to field crews in preparation for rare species inventories. The rare plant list for the state, administered and updated annually by the INPS, was consulted regarding rank or relative rarity of each species. Several technical keys were used to identify plant species, including Hitchcock and Cronquist (1973),Hitchcock et al. (1977-1990), Cronquist et al. (1977, 1984), Welsch et al. (1987) and Barneby (1989).

3.1. Field Methods

Whenever possible, a visit to a known population of a species was made before an inventory began. This served to build a "search image" for the species as well as its habitat and to facilitate upcoming inventories. All known areas of suitable habitat were identified from aerial photographs and through consultation with people familiar with the study area. These areas were inventoried systematically during the peak flowering period for each species. Additional surveys were carried out on IPC land holdings in the vicinity of the study area using the same systematic search technique. Once on site, biologists determined the boundaries of the area requiring survey, and walked back and forth at regular intervals across the area searching for the rare species. The distance between search lines was related to the structural complexity of the habitat, and the typical size of the rare species. Small plants and densely vegetated habitats generally required a small, close travel pattern.

When a rare species was encountered, the phenologic, demographic, and topographic characteristics were recorded for the population as well as the associated plant species, adjacent unoccupied habitat, threats to continued existence and conservation strategies for protection. All information was recorded on a standard reporting form proscribed by the CDC (Appendix 3). Population boundaries were mapped on 7.5 minute USGS topographic quadrangles. Population boundaries can be difficult to define in the field. Personnel were instructed to map boundaries at natural breaks between adjacent populations (e.g., a narrow talus slope bounded on two sides by one rare plant species). If natural breaks were not apparent the populations were considered unique when plants were separated by more than 60 m. Populations with fewer than six plants and occupying less than 2 m^2 were mapped as a point. The polygons and points were labeled by species and given a unique numeric identifier. Slide photographs of the plant and the habitat were taken as additional documentation. A specimen was collected when necessary to document species' identification and location. Specimens were archived in the Idaho Power Company herbarium and also, in some cases, sent to regional university herbaria. All completed report forms were sent to the CDC.

3.2. Analysis

Population boundaries were digitized into Arc-Info format compatible with IPC's Geographic Information System. Population occurrences were compared with soil maps for Twin Falls, Jerome, and Elmore counties and vicinities to determine which soil map units supported rare plant populations. An attempt was made to relate rare species distributions to five edaphic and six topographic and vegetative characteristics (Table 2). Edaphic information was provided by the Idaho Natural Resources Conservation Service (NRCS) from draft digitized maps and associated databases for the study area. The relative area of each vegetation cover type, and relative frequency of occurrence of each soil surface texture, and classes (high, medium, low) of clay, sand and gravel content were compared to the same type of data for all locations bearing rare plant populations. Data for other edaphic factors were incomplete at the time of this report and could not be used for additional analyses.

4. Results

4.1. Agency Consultation

Twenty-five rare vascular plants and one cryptogam were identified as possibly occurring in the study area during the 1989 consultation period (Table 1). Since that time three species were determined to be widespread and thus were dropped from the INPS Rare Plant List: ***Malacothrix torreyi***, dropped in 1990; ***Astragalus atratus*** var. ***owyheensis*** and ***Gymnosteris nudicaulis***, dropped in 1994. ***Mentzelia torreyi*** var. ***acerosa*** was moved from State Sensitive to State Monitor status (1991 Rare Plant Conference) then dropped (1995 Rare Plant Conference), largely as a result of work performed by Idaho Power biologists to document the occurrence of the species within the study area; ***Asclepias incarnata*** was added to the State Review list (1993 Idaho Rare Plant Conference) then dropped because of its abundance, (1995 Idaho Rare Plant Conference); and ***Astragalus atratus*** var. ***inseptus*** was recommended for removal from the Federal Candidate list and placement in the State Sensitive category (1994 Idaho Rare Plant Conference).

4.2. Field Inventories

Four species of rare plants were found in the study area: ***Astragalus purshii*** var. ***ophiogenes*** (Pursh's milkvetch), ***Epipactis gigantea*** (chatterbox orchid), ***Eriogonum shockleyi*** var. ***shockleyi*** (matted cow-pie buckwheat), and ***Mentzelia torreyi*** var. ***acerosa*** (Torrey's blazing-star) (Table 3, Figure 7). ***Epipactis gigantea*** was associated with flowing water. The other species occupied upland habitats. One additional species, ***Penstemon janishiae***, was reported from an historic location in the Dike Reach, but was not observed.

4.2.1. *Astragalus purshii* var. *ophiogenes*

Ten populations, totaling approximately 2,786 individuals, were found along the Wiley Reach (Appendix 5) in sandy soils dominated by ***Artemisia tridentata*** ssp. ***wyomingensis***. All populations were located during flower and fruiting phases. The total area occupied by the species was estimated at 20,793 m^2 (Table 3). One population was directly impacted by periodic vehicular traffic, two were adjacent to a lightly traveled road track, the others were in grazed areas. One population was discovered across the river from the recent Bliss landslide; an unknown number of individuals was lost when the river eroded the south bank as a result of the landslide (S. Popovich, Shoshone Distr., BLM, *pers. comm.*). The variety of ***Astragalus purshii*** at the landslide has not been confirmed. The populations in road tracks did not appear to be in decline. Flowers and fruit were present on most plants found in the study area.

Astragalus purshii var. ***ophiogenes*** occurred in six cover types at proportions different from the proportion of cover types occurring in the study area (Table 4). The most frequently occupied cover type was *Shrub Savanna* (66.3%), followed by *Desertic Shrubland* (19.6%).

Habitat characteristics for the known populations were highly variable (Table 5). Each population occurred at a different aspect and on different topographic positions. The largest population occurred on a W-SW-facing aspect. The species more frequently occupied the crest or upper portion of a slope. ***Astragalus purshii*** var. ***ophiogenes*** generally occupied areas with slopes less than 10% that occurred between elevations 2700 and 2850 ft. All populations were located in the open spaces between shrubs. Few plants were observed growing under the canopy of other species. Soils occupied by ***A. purshii*** var. ***ophiogenes*** tended to have low clay content and very little gravel (Table 6). Comparison of the NRCS soils map to the distribution of ***A. purshii*** var. ***ophiogenes*** suggested very fine sandy loam textured soils were the most commonly occupied, followed by bouldery-fine sandy loam and loamy soils (Table 7).

4.2.2. *Epipactis gigantea*

Four populations were found scattered within the study area, three in association with natural spring outflow and one on a seep adjacent to an artificial pond. The largest population was growing in open, herbaceous vegetation and the ***Betula occidentalis*** *Forested Wetland* communities of Minnie Miller Springs at The Nature Conservancy's Thousand Springs Preserve, near Wendell. Three of the populations were found in association with ***Betula occidentalis*** communities. The remainder was growing with ***Salix exigua***- and ***Urtica dioica***-dominated communities.

Epipactis gigantea occurred in four cover types (Table 4) at proportions different from the proportion of cover types occurring in the study area. The cover type with the most acreage occupied by ***Epipactis gigantea*** was *Forested Wetland* (55.4%), followed by *Scrub-Shrub Wetland* (31.8%).

Habitat characteristics for the known populations of ***E. gigantea*** were the least variable of the rare species found in the study area (Table 5). ***Epipactis gigantea*** tended to occur on westerly aspects and on mid-slope and lower elevation positions. ***Epipactis gigantea*** generally occupied slopes less than 35% that occurred between elevations 2730 and 3040 ft. All populations were located in the understory of woody vegetation. Soils occupied by ***E. gigantea*** tended to have low clay content and very little gravel although one site was classified as being very gravelly (Table 6). Comparison of the NRCS soils map to the distribution of ***E. gigantea*** suggested very fine sandy loam textured soils were the most commonly preferred, followed by bouldery-fine sandy loam and loamy fine sands (Table 7).

4.2.3. *Eriogonum shockleyi* var. *shockleyi*

Three populations were discovered growing on poorly vegetated, white, alkaline silts along the rim of the Malad River Canyon and the Snake River Canyon above Lower Salmon Dam. The Malad Gorge population, approximately 2000 individuals, was located within the boundaries of IDPR's Malad Gorge State Park. The population is disturbed by the activities of hoary marmots, but does not appear to be in decline. The second population, a total of approximately 369 plants occupying 84 m^2, was found near the dam during a survey of transmission line corridors. It is bisected by an unimproved road that is traveled several times per year. The road is not associated with the transmission line. The third population is located within Hagerman Fossil Beds National Monument and lies undisturbed. Approximately 315 plants occupying 1215 m^2 were found.

Distinguishing between ***Eriogonum shockleyi*** variety ***shockleyi*** and ***E. shockleyi*** variety ***packardae*** can be difficult. During the growing season of 1995, the CDC, on behalf of the BLM, investigated all known populations of both varieties in Idaho. The initial conclusions are that all known populations of ***E. shockleyi*** growing south of the Bruneau River, a tributary to the Snake River (RM 494.9) are variety ***shockleyi***; all known populations growing north of the Bruneau River are variety ***packardae***; and all populations growing in the Bruneau River basin are a combination of both varieties with occasional populations of one variety (Moseley, CDC, *pers. comm.*). Some additional work remains prior to confirmation. At this time the variety found in the Hagerman Study Area is considered to be ***shockleyi***.

Eriogonum shockleyi occurred in the *Shrubland* cover type. The habitat occupied by ***E. shockleyi*** was along the rim of the Snake River and Malad River canyons on fine textured soils with little slope apparent (Tables 5 and 6). The elevations of the sites were approximately 3375 ft. The Lower Salmon Falls populations were growing in a clearing surrounded by an ***Artemisia tridentata*** ssp. ***wyomingensis*** plant association. The soil occupied by ***E. shockleyi*** tended to have a low sand content, very little gravel and a high (3-8%) to very high (8%) calcium carbonate content (Table 6). Based on soil particle information provided by the NRCS, the soil appears to be a clay or silty clay (Table 7).

4.2.4. *Mentzelia torreyi* var. *acerosa*

Fifty-five populations (approximately 23,325 individuals) of ***Mentzelia torreyi*** var. ***acerosa*** were found in the vicinity of Bliss Reservoir growing in the deep, red-brown volcanic cinder deposits characteristic of the area. The species turned out to be so common that some populations were mapped and counted, but not described further. Vegetation of these soils was confined to sparsely distributed forbs, in particular ***Astragalus nudisiliquus*** and ***Nama aretioides***, with scattered ***Purshia tridentata, Artemisia tridentata*** and ***Chrysothamnus nauseosus*** shrubs. Downstream of Bliss Reservoir an additional 20 populations (16,923 individuals) were found. Two populations (approximately 610 and 159 individuals) were found upstream of Bliss Reservoir, within the study area, in the upland areas near Banbury Springs on light colored clayey soils scattered among the surface basalt present in the area and in similar soils on the Wiley Reach. All of the upstream populations were growing in association with ***Artemisia tridentata*** ssp. ***wyomingensis/Bromus tectorum*** communities. In total, ***Mentzelia torreyi*** var. ***acerosa*** occupied an approximate area of 341,495.2 m^2.

Mentzelia torreyi var. ***acerosa*** occurred in 12 cover types (Table 4) at proportions different from the proportion of cover types occurring in the study area. The cover type with the most acreage occupied by ***Mentzelia torreyi*** was *Shrubland* (69.5%), followed by *Shrub Savanna* (17.2%).

Steep, north and northwest-facing aspects appeared to be the preferred habitat of ***M. torreyi*** var. ***acerosa*** (Table 5). A majority of the populations occurred at upper and mid-slope positions between elevation 2600 and 3050 ft and in areas with little or no overhead canopy. Soils occupied by ***M. torreyi*** var. ***acerosa*** tended to have low clay content and little gravel, although 1.6% of the total area occupied could be expected to have greater than 33% gravel content based on the description of the soil types (Table 6). Clay, sand and gravel content of occupied soils appeared to be different from the soil characters present throughout the entire study area. Comparison of ***M. torreyi*** var. ***acerosa*** to the NRCS soils map suggested fine sandy loam textured surface soils were the most commonly occupied, followed distantly by loam and loamy fine sands (Table 7).

4.2.5. *Penstemon janishiae*

One historic population of ***Penstemon janishiae*** was identified by the CDC as occurring in the study area, specifically Big Pilgrim Gulch in the Dike Reach in 1980 (herbarium record: Smithman 498, New York Botanical Garden). The population occurred on a north-facing slope on lacustrine, clay soils. No population data were included. Surveys of the Big Pilgrim Gulch were performed in 1990 during inventories for rare plant species, but no ***P. janishiae*** was reported. The site was severely disturbed by a large rainfall event during the summer of 1991. Several natural drainages were scoured to bedrock, including Big Pilgrim Gulch, possibly resulting in severe disturbance to the available ***Penstemon*** habitat.

Two additional populations were reported by BLM in Big Pilgrim Gulch and Deer Gulch. Both sites are within the Dike Reach project area. The population in Big Pilgrim Gulch may be that described by Smithman. Limited population data have been collected to date, but a total of 18 plants were counted in 1993 and 1994 (J. Klott, BLM, *pers. comm.*) No habitat data specific to these populations are available.

5. Discussion

A total of 101 rare plant populations were found across the entire study area. Many of them were new sightings as most of the Hagerman Study Area had not been inventoried prior to 1990. Most of the study area was inventoried for this study, but it is likely that there are additional populations as yet undiscovered.

The highest density of rare plant populations occurred around Bliss Reservoir, principally because the distribution of ***M. torreyi*** var. ***acerosa*** is centered there (Figure 7). The volcanic cinder soil present around Bliss Reservoir and specific areas of lacustrine deposits up- and downstream are preferred by ***M. torreyi*** var. ***acerosa*** and appear to be limited in distribution, although locally common within the study area.

Based on the habitat data collected for the rare species in the study area, the four species located by IPC biologists have very different habitat characteristics. ***Epipactis gigantea*** has an affinity for semi-aquatic habitat, stays low on the slope and on nearly flat areas, and prefers shady habitats. This is supported by the preference of ***E. gigantea*** for *Forested Wetland* and *Scrub-Shrub* wetland cover types. Both of these cover types have a high (97-125%) canopy coverage (Appendix E.3.3-A). The upland species, ***Mentzelia torreyi*** var. ***acerosa*** and ***Astragalus purshii*** var. ***ophiogenes***, shared a preference for open canopies in the surrounding vegetation and occurred on almost all aspects and topographic positions, but ***M. torreyi*** var. ***acerosa*** tended to occupy much steeper slopes. In addition, ***M. torreyi*** var. ***acerosa*** also occurred more frequently in the *Shrubland* cover type, while ***A. purshii*** var. ***ophiogenes*** preferred the cover types with much less woody cover: *Shrub Savanna* and *Desertic Shrubland*. The third upland species, ***Eriogonum shockleyi*** var. ***shockleyi***, occupied the crest of slopes in areas with open canopied plant communities, light-colored silty clay soils and high calcium carbonate concentrations. The known populations of ***E. shockleyi*** var. ***shockleyi*** also are reported to occupy soils with a gravelly 'pavement' surface although that information was not expressed in the NRCS soil data provided for the soil type occupied by the species. Overall, the preferred soil characteristics for the three previously mentioned species were similar to one another, generally fine sands or loams, with low clay and gravel content. The soils data provided by the GIS database are not site specific, thus the data can only be used to surmise possible associations, but it appears to be sufficient to suggest the species may select particular soil characteristics.

The disturbance responses of the rare species found in the study area have not been studied directly. However, some speculation about disturbance impacts can be made based on the habitat characteristics of several species. For example, a number of ***A. purshii*** var. ***ophiogenes*** populations occurred in disturbed habitats. Eidemiller (1977*b*) reported that ***A. purshii*** is likely positively influenced by grazing disturbance. She suggested the genus ***Astragalus***, in general, responds positively to disturbance. This suggestion is further supported by Packard et. al (1980) who indicated ***A. purshii*** var. ***ophiogenes*** is adapted to habitats that are naturally disturbed. The species often grows on partially active sand dunes. Packard et al. (1980) identified ***A. purshii*** var. ***ophiogenes*** as a pioneer species because of its substrate preference. This may explain the ability of ***A. purshii*** var. ***ophiogenes*** to persist in the face of anthropomorphic disturbances (if native vegetation is not replaced with cropland). Packard et al. (1980) identified agricultural development as the principal threat to local populations of ***A. purshii*** var. ***ophiogenes***, but stated that "...because of its nearly continuous distribution with no major overall threats, the taxon is not in immediate danger."

Epipactis gigantea is widespread throughout the Intermountain Region, but because of its proclivity for thermal and cold spring habitats, it is threatened by development and recreation (Mancuso 1991). With the exception of Box Canyon, located upstream of the study area, ***E. gigantea*** is known to occur in all free-flowing springs remaining in the Thousand Springs Reach of the Snake River, suggesting the species may have been much more abundant historically. Most of the springs in the area have been developed for commercial use, thereby reducing the spring habitat in the middle Snake River available for colonization. Mancuso (1991) indicated that diversion of water flow away from a creek channel is likely to contribute to the demise of an ***E. gigantea*** population on the Payette National Forest. Therefore it is possible for continued development of spring systems along the Snake River to result in the elimination of ***E. gigantea***

from all but the deliberately protected springs in the area (e.g., The Nature Conservancy's Thousand Springs Preserve).

Eriogonum shockleyi var. ***packardae*** is an extremely rare species in Idaho. As of 1993 only seven populations were known, two of them discovered in 1990 and 1991. Two additional populations were discovered in 1994. With the final confirmation of varietal identity this population count is likely to change. Although variety ***shockleyi*** may ultimately prove to be more common as a result of the findings of the BLM-CDC study, ***Eriogonum shockleyi*** var. ***shockleyi*** is the most rare of the rare plant species found in the Hagerman Study Area.

Under existing operating plans, the hydroelectric facilities in the Hagerman Study Area are unlikely to impact any of the rare species present in the area. Three of the four species observed are located in upland habitats beyond the zone of influence of hydro operation. The springs in which ***E. gigantea***, the fourth species, grows are not affected by water level fluctuations created by hydro operation because the springs are located above the high water mark typically observed today.

6. Conclusions

Four species of rare plants were found in the Hagerman Study Area during the study period. A fifth species documented in the study area historically, and reported recently by BLM personnel, was not observed. None of the species are considered Threatened or Endangered although one, ***Astragalus purshii*** var. ***ophiogenes***, is considered a 3C species. All of the species occur on the INPS Species of Special Concern list. All but ***Astragalus purshii*** var. ***ophiogenes*** are on the BLM Sensitive Species List (Moseley and Groves 1992). One species prefers aquatic habitats, the other three occupy upland habitats. The type and amount of woody overstory species appear to have a significant influence on rare species distributions. ***Mentzelia torreyi*** var. ***acerosa***, ***Astragalus purshii*** var. ***ophiogenes*** and ***Epipactis gigantea*** tended to occupy structurally different cover types. While soil characteristics of sites occupied by rare species appeared to be somewhat similar, the rare species did appear to select particular soils when compared to what was available within the study area in general. Topographic attributes such as percent slope and topographic position also appeared to have an influence over distribution of rare species.

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Table 1. Plant species thought to be rare and thought to occur in the vicinity of the Snake River between Shoshone Reservoir and Swan Falls Dam (Moseley, IDFG, *pers. comm.*, 1989; Rosentreter, BLM, *pers. comm.*, 1989). Species rank shown as provided by the Idaho Native Plant Society (INPS), (1989) and Moseley and Groves (1992).

Species	1989 Status	1995 Status
Allium anceps Kellog	Priority 2	Priority 2, BLM Sensitive
Asclepias incarnata L.		Dropped
Astragalus atratus S. Wats. var. *inseptus* Barneby	Federal Candidate (C2)	Sensitive, Federal Candidate (3C), BLM Sensitive
Astragalus atratus S. Wats. var. *owyheensis* (A. Nels. & J.F. Macbr.) M.E. Jones	Sensitive	Dropped
Astragalus camptopus Barneby	Federal Candidate (3C)	Monitor, BLM Sensitive
Astragalus kentrophyta Gray var. *jessiae* (M.E. Peck) Barneby	Sensitive	Dropped, BLM Sensitive
Astragalus mulfordae M.E. Jones	Federal Candidate (C2)	Federal Candidate (C1), BLM Sensitive
Astragalus purshii Dougl. ex Hook. var. *ophiogenes* (Barneby) Barneby	Sensitive; Federal Candidate (3C)	Sensitive; Federal Candidate (3C)
Blepharidachne kingii (S. Wats.) Hack.	Priority 1	Priority 1, BLM Sensitive
Chaenactis cusickii Gray	Priority 1	Priority 1, BLM Sensitive
Cleomella plocasperma S. Wats.	Priority 1	Priority 1, BLM Sensitive
Cymopteris acaulis (Pursh) Raf. var. *greeleyorum* J. Grimes & Packard	Sensitive	Sensitive, BLM Sensitive
Cymopteris corrugatus M.E. Jones	Review	Dropped
Dimeresia howellii Gray	Priority 2	Priority 2, BLM Sensitive
Eatonella nivea (D.C. Eat.) Gray	Monitor	Sensitive, BLM Sensitive
Epipactis gigantea Dougl. ex Hook.	Priority 2	Priority 2, BLM Sensitive
Eriogonum ochrocephalum S. Wats. var. *sceptrum*	Review	Dropped
Eriogonum shockleyi var. *packardae* Reveal	Priority 1	Priority 2, BLM Sensitive
Eriogonum shockleyi S. Wats. var. *shockleyi*	Sensitive	Sensitive, BLM Sensitive
Glyptopleura marginata D.C. Eat.	Priority 1	Sensitive, BLM Sensitive
Gymnosteris nudicaulis (Hook. & Arn.) Greene	Monitor	Dropped, BLM Sensitive

Table 1. (Continued)

Species	1989 Status	1995 Status
Lepidium davisii Rollins	Federal Candidate (C2)	Federal Candidate (C2), BLM Sensitive
Lepidium papilliferum (Henderson) A. Nels. & J.F. Macbr.	Priority 2	Federal Candidate (C2), BLM Sensitive
Malacothrix glabrata (D.C. Eat. ex Gray) Gray	Sensitive	Dropped
Malacothrix torreyi Gray	Monitor	Dropped
Mentzelia torreyi Gray var. *acerosa* (M.E. Jones) Barneby	Sensitive	Dropped, BLM Sensitive
Oxytheca dendroidea Nutt.	Sensitive	Sensitive, BLM Sensitive
Penstemon janishiae N. Holmgren	Priority 2	Priority 2, BLM Sensitive
Peteria thompsonea S. Wats.	Priority 1	Priority 1, BLM Sensitive
Phacelia minutissima Henderson	Priority 1	Federal Candidate (C2), BLM Sensitive

Table 2. Edaphic, topographic and vegetative characteristics used to describe preferred habitat of rare plant species found in the Hagerman Valley. Edaphic data were taken from the draft Digital Soil Map and associated databases provided by the Natural Resources Conservation Service.

Edaphic	percent clay percent sand percent gravel calcium carbonate surface texture
Topographic	aspect slope topographic position
Vegetation	cover type canopy light penetration community setting

Table 3. Total number of individuals, area occupied and total number of populations of rare plant species found in the Hagerman Study Area, 1990-1994. [a] indicates a minimum estimate as a result of missing data.

Species	Total no. individuals	Total area occupied (m^2)	Total no. populations
Astragalus purshii var. *ophiogenes* [a]	2786	20,792.7	14
Epipactis gigantea	2222	12,105.0	4
Eriogonum shockleyi var. *shockleyi*	2684	9,398.2	3
Mentzelia torreyi var. *acerosa* [a]	41,047	516,795.6	88

Table 4. Percentage of cover types occupied by rare plant populations found in the Hagerman Study Area, 1990-1994. Cover types are based on the H.E.P. Classification system (USFWS 1981). The non-emergent wetland cover type was created by IPC.

Cover type	Relative percent of each cover type (%)	Proportion of cover types occupied by rare plant populations			
		Aspu[1]	Epgi[2]	Ersh[3]	Meto[4]
Emergent Herbaceous Wetland	0.5	0	0	0	0
Non-emergent Herbaceous Wetland	1.0	0	0	0	0
Shore and Bottomland Wetland	0.1	0	0	0	0
Scrub-Shrub	4.3	4.1	31.8	0	1.0
Forested Wetland	0.9	0	55.4	0	0
Lotic	14.1	0	0.3	0	0
Forested Upland	0.1	0	0	0	0.1
Shrubland	28.3	3.7	0	100.0	69.5
Shrub Savanna	8.9	66.3	0	0	17.2
Tree Savanna	0.1	0	0	0	0
Desertic Woodland	0.1	0	0	0	0
Desertic Shrubland	4.1	19.6	0	0	1.3
Desertic Herbland	0.1	3.9	0	0	0
Grassland	4.9	0	0	0	4.9
Forbland	0.9	0	0	0	<0.1
Barrenland	0.5	0	0	0	1.7
Cliff/Talus	1.0	0	0	0	0.9
Disturbed	2.0	0	12.5	0	0.8
Grazing Land/Pasture	7.7	0	0	0	0.7
Roads	1.6	2.4	0	0	1.9

[1]Aspu = *Astragalus purshii* var. *ophiogenes*, [2]Epgi = *Epipactis gigantea*, Ersh = [3]*Eriogonum shockleyi* var. *shockleyi*, [4]Meto = *Mentzelia torreyi* var. *acerosa*

Table 5. Habitat characteristics of rare plant species found in the Hagerman Study Area, 1990-1994. The number of populations with a particular habitat characteristic is shown.

Characteristics	Species			
	Astragalus purshii var. ophiogenes	Epipactis gigantea	Eriogonum shockleyi var. shockleyi	Mentzelia torreyi var. acerosa
Aspect				
N	2	0	0	18
NE	1	0	0	4
E	0	0	1	4
SE	1	0	0	3
S	2	1	0	8
SW	1	1	0	8
W	1	3	0	8
NW	1	1	0	13
Slope				
0-10	5	2	1	6
10-35	1	2	0	11
35+	0	0	0	20
Light				
Open	6	0	1	27
Partial	1	1	0	5
Filtered	0	3	0	1
Shade	0	2	0	0
Topographic position				
Crest	2	0	1	19
Upper slope	2	1	0	25
Mid slope	1	2	0	23
Lower slope	1	2	0	15
Bottom	1	2	0	3

Table 6. Relative proportion of soils (% ha) with high, moderate, and low fractions of clay, sand, and gravel in the upper 154 cm of soil in the Hagerman Study Area and for soils occupied by rare plant populations. Based on USDA-Natural Resource Conservation Service Draft digital soil maps and associated databases.

	Study area soils			Astragalus purshii var. ophiogenes			Epipactis gigantea		
Soil character	%H	%M	%L	%H	%M	%L	%H	%M	%L
Clay[1]	8.4	0.01	91.6	0	0	100	0	0	100
Sand[2]	2.2	30.5	67.3	0	31.5	68.5	0	73.8	26.2
Gravel[3]	6.5	1.4	92.1	0	0	100	0.4	0	99.6

[1]Clay High (H) = more than 60% clay fraction
Mod (M) = less than 60%, but more than 35% clay fraction
Low (L) = less than 35% clay fraction

[2]Sand High (H) = more than 66.6% sand fraction
Mod (M) = less than 66.6%, but more than 33.3% sand fraction
Low (L) = less than 33.3% sand fraction

[3]Gravel High (H) = more than 66.6% gravel fraction
Mod (M) = less than 66.6%, but more than 33.3% gravel fraction
Low (L) = less than 33.3% gravel fraction

Table 7. Relative abundance of surface soil textures (% of total ha) occurring in the Hagerman Study Area and for soils occupied by rare plant populations. Based on USDA-Natural Resource Conservation Service Draft digital soil maps and associated databases.

	proportion of each textural class on:				
Surface texture	Study Area	Astragalus purshii var. ophiogenes sites	Epipactis gigantea sites	Eriogonum shockleyi var. shockleyi sites	Mentzelia torreyi var. acerosa sites
Fine Sandy Loam	47.4	0	6.6		84.0
Very Fine Sandy Loam	14.7	53.6	68.1		<0.1
Loamy Fine Sand	9.5	2.9	7.4		4.4
Bouldery Fine Sandy Loam	6.2	22.0	17.9		<0.1
Loam	5.7	21.5	0		5.2
Sandy Loam	3.0	0	0		1.2
Fine Sand	3.1	0	0		0.9
Silt	2.8	0	0		0
Bouldery Loamy Sand	2.1	0	0		0.3
Loamy Sand	2.0	0	0		1.7
Extremely Stony Fine Sandy Loam	1.7	0	0		0
Extremely Stony Sandy Loam	1.1	0	0		0
Coarse Sandy Loam	0.4	0	0		0.2
Very Stony Fine Sandy Loam	0.3	0	0		2.0
Clay Loam	<0.1	0	0		0
Loamy Very Fine Sand	<0.1	0	0		0

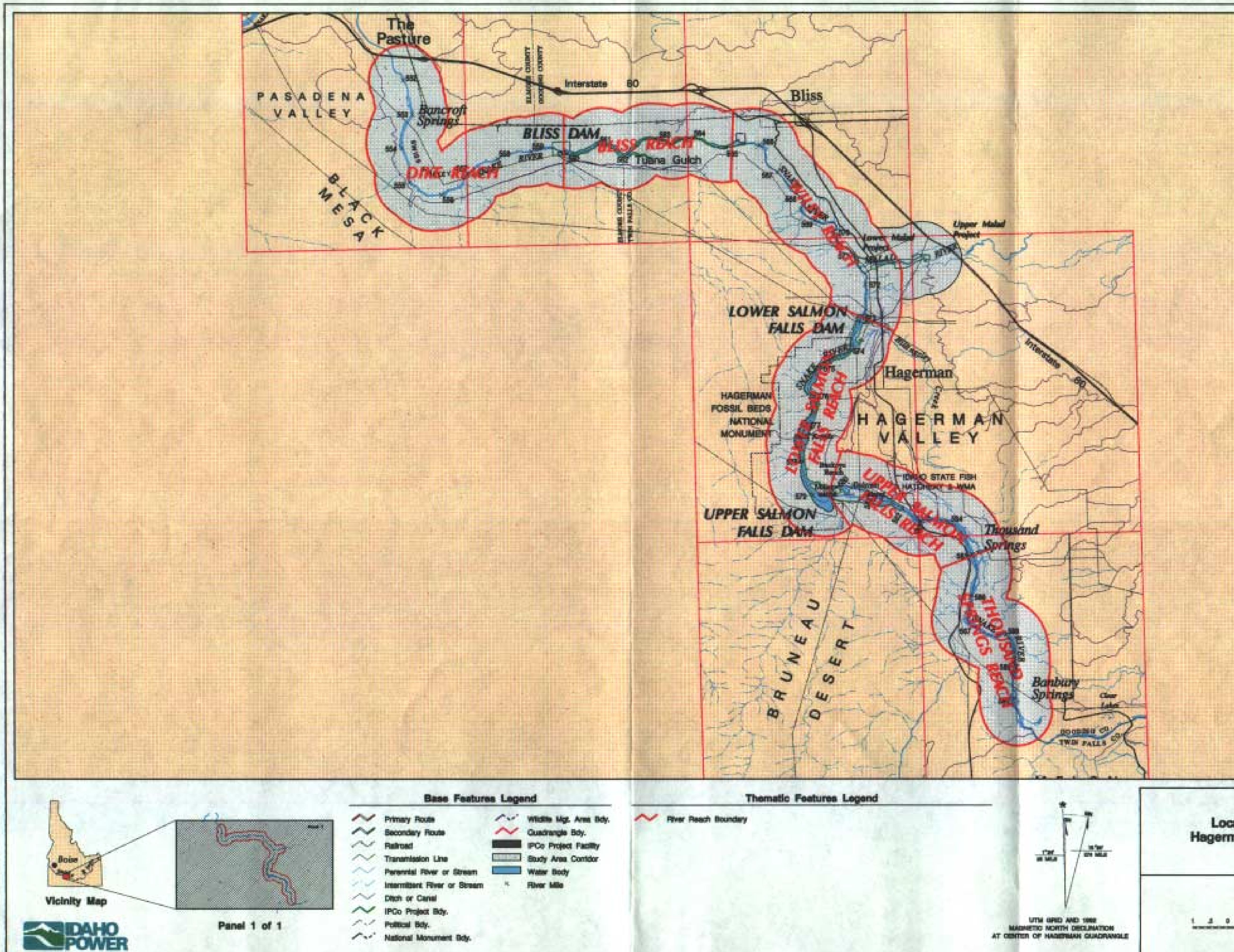
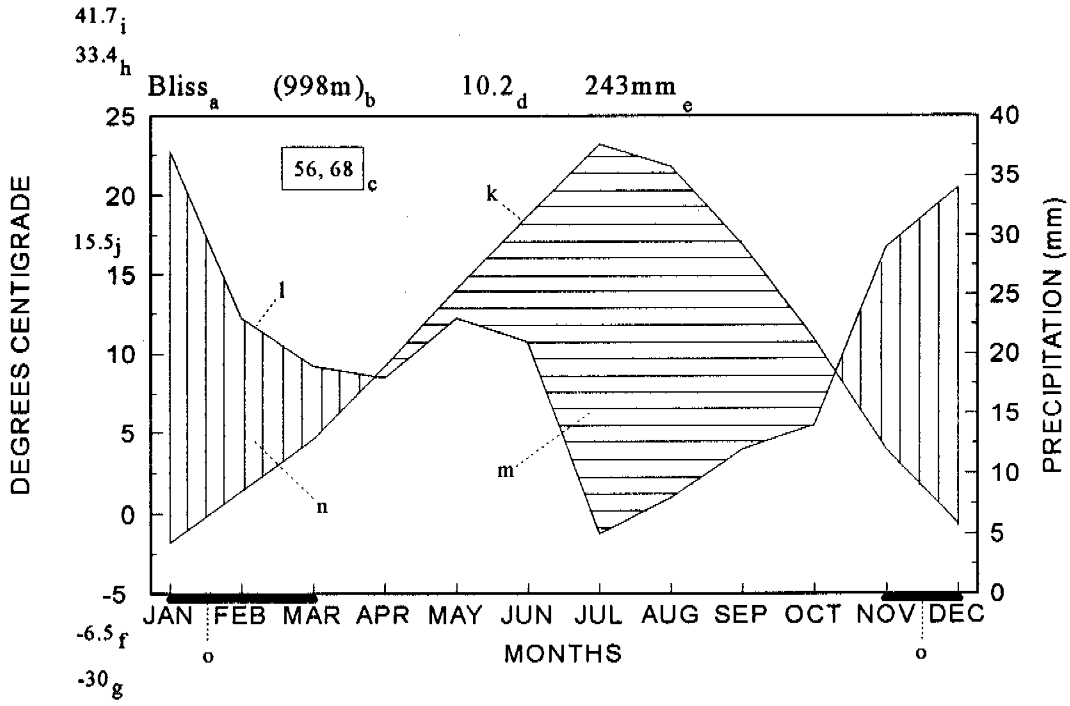


Figure 1

Location of the Hagerman Study Area

Figure 2. Köppen climate diagram for the Bliss weather station, Hagerman Study Area, southwestern Idaho



a: Station
b: Elevation
c: Number of years of observation (temperature, precipitation)
d: Mean annual temperature in °C
e: Mean annual precipitation in millimeters
f: Mean daily minimum of the coldest month
g: Lowest recorded temperature
h: Mean daily maximum of the hottest month
i: Highest recorded temperature
j: Mean daily temperature range
k: Monthly means of temperature in °C
l: Monthly means of precipitation in millimeters
m: Arid period (horizontal hatched)
n: Humid period (vertical hatched)
o: Months with an absolute minimum below 0 °C

Figure 3. Global (a) and regional (b) distribution of *Astragalus purshii* var. *ophiogenes.*

(a) (b)

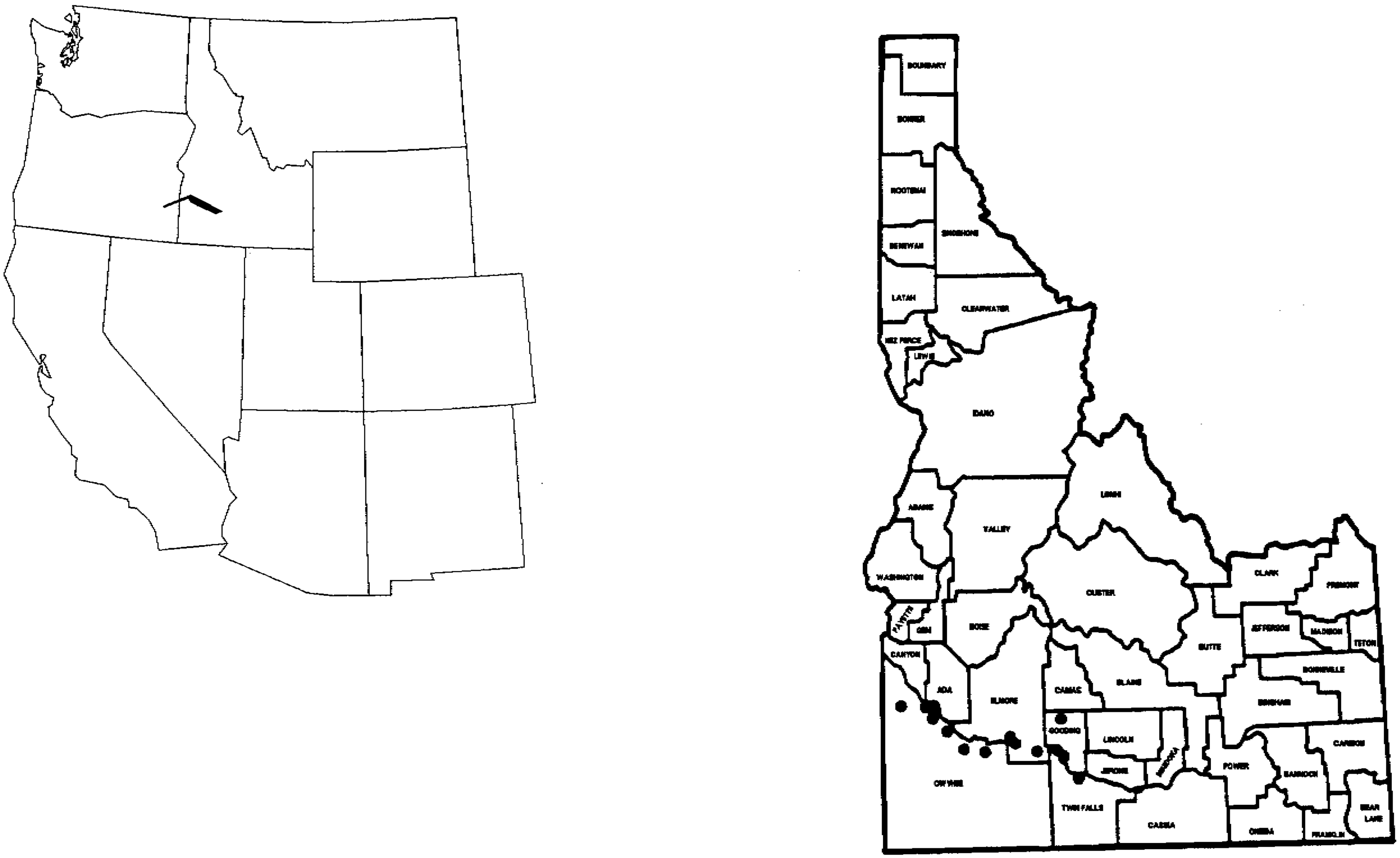
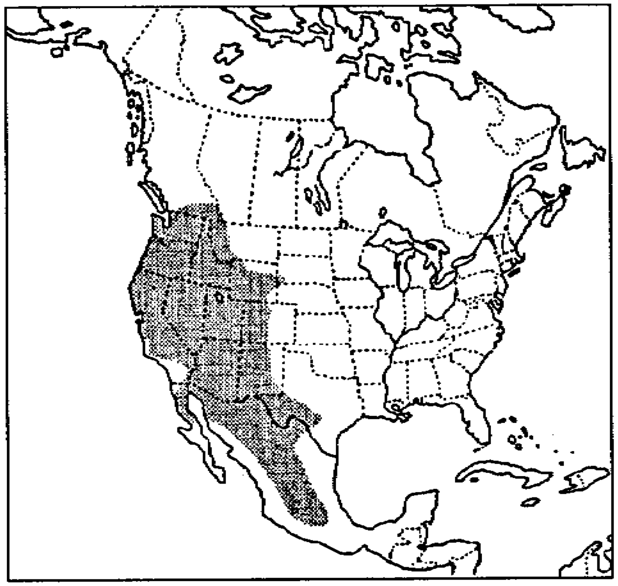


Figure 4. Global (a) and regional (b) distribution of *Epipactis gigantea*. Figure (4*a*) is reprinted by permission from The Native Orchids of the United States and Canada, excluding Florida, p. 78, by C. A. Luer, copyright 1975, The New York Botanical Garden.

(a)



(b)

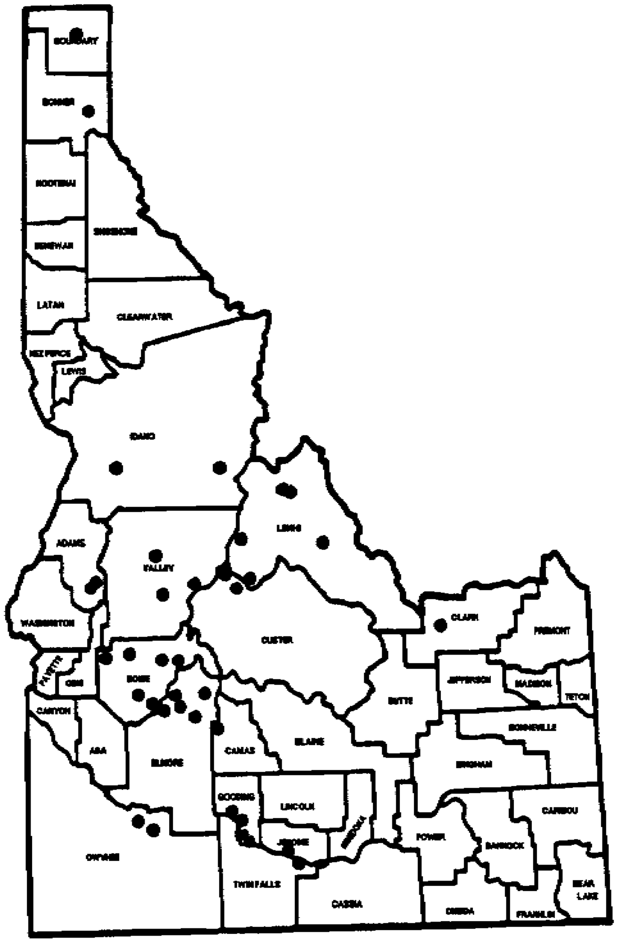


Figure 5. Global (a) and regional (b) distribution of *Eriogonum shockleyi* vars. *shockleyi* and *packardae*. The data represent information collected prior to 1995.

(a) (b)

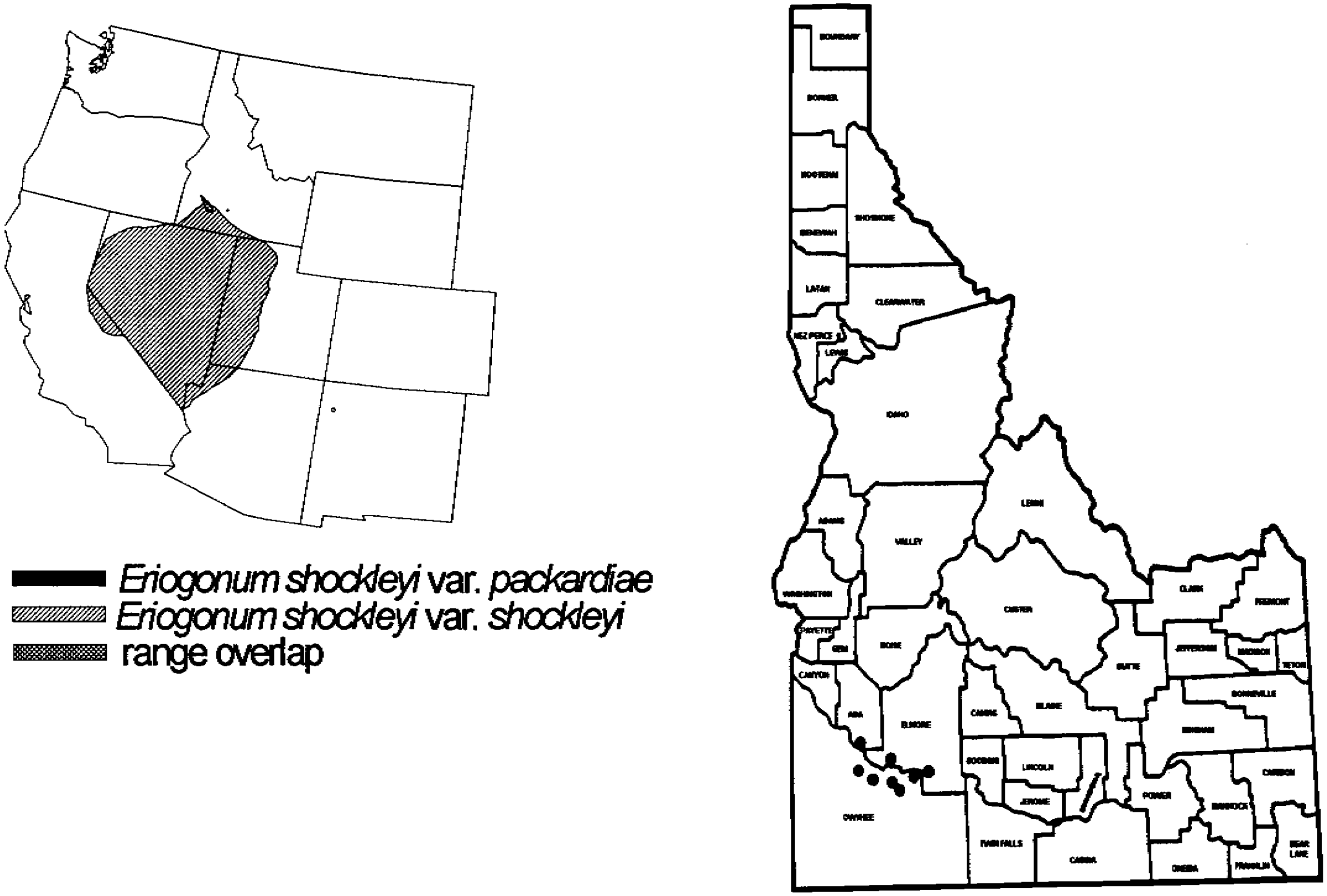
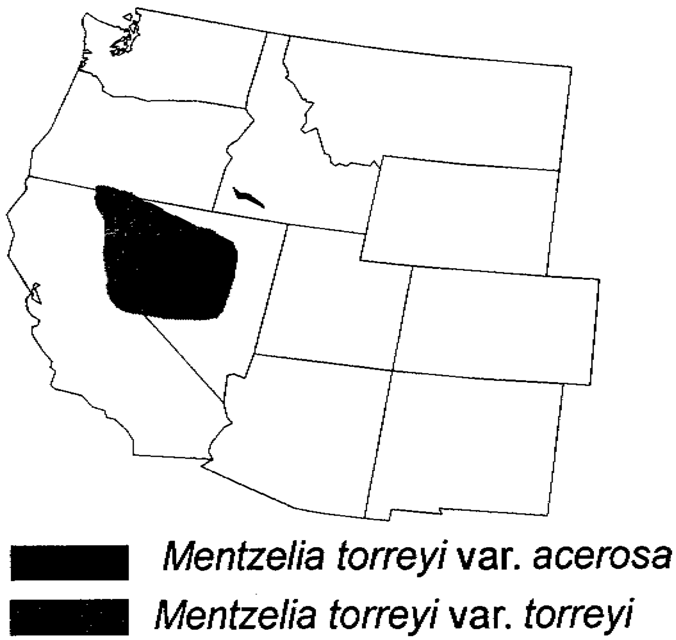
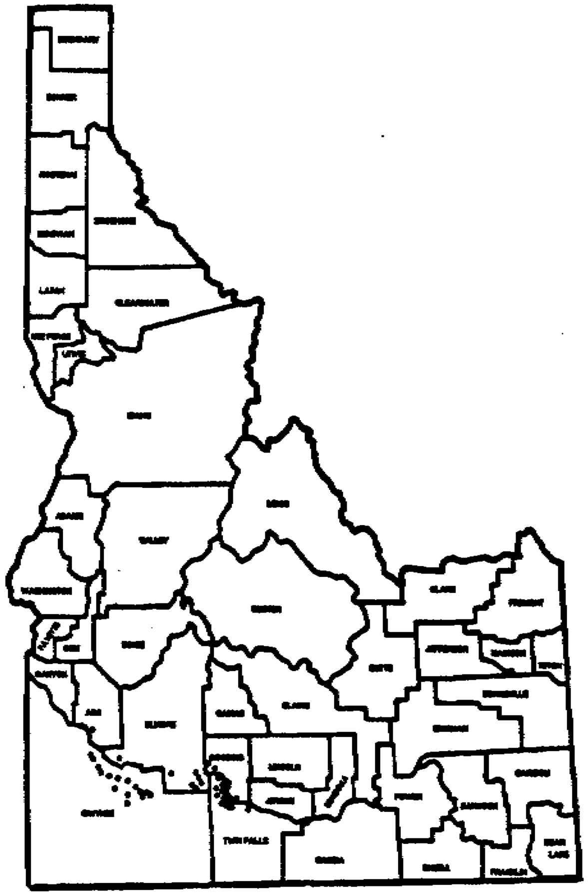


Figure 6. Global (a) and regional (b) distribution of *Mentzelia torreyi* var. *acerosa*

(a)



(b)



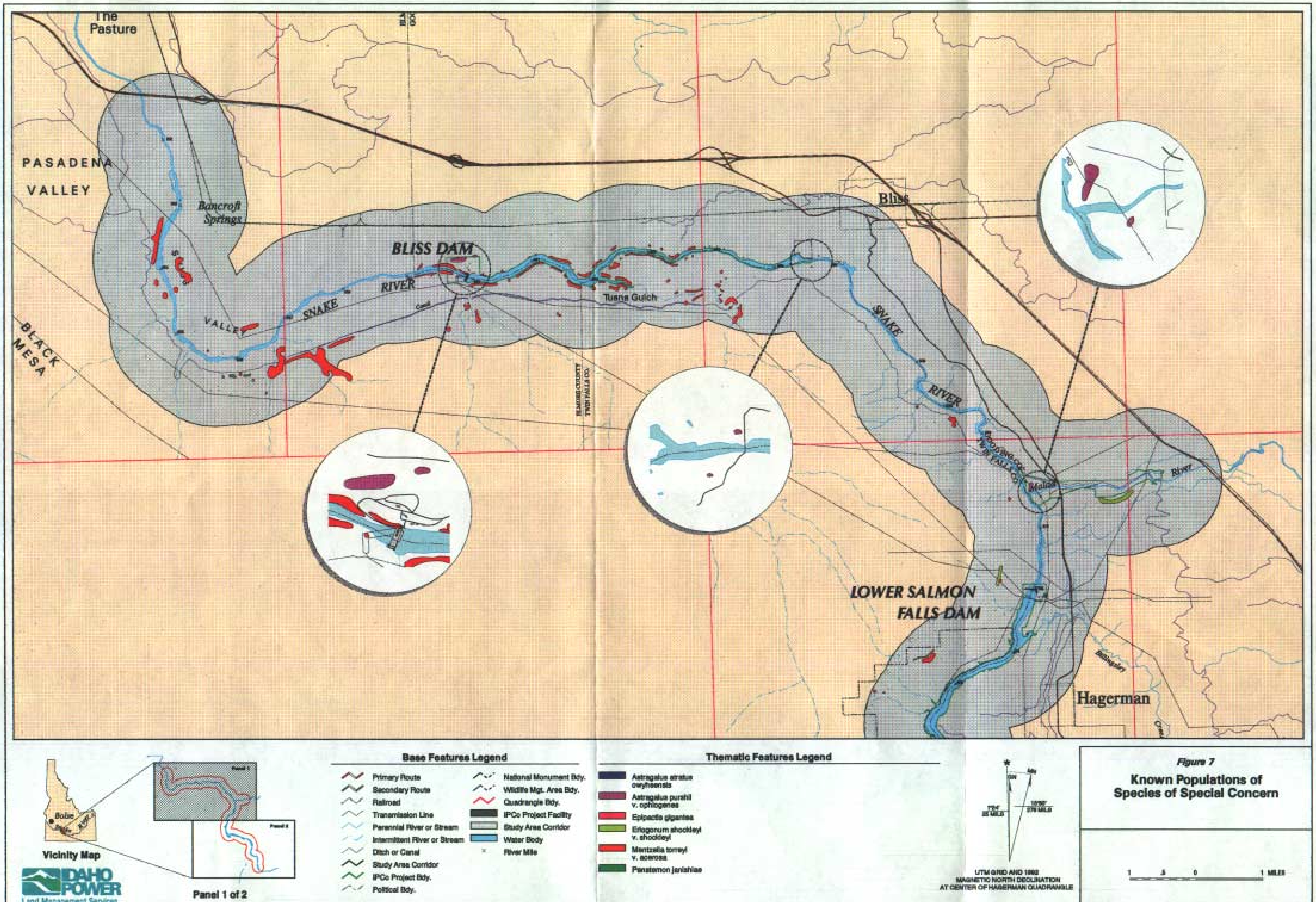


Figure 7

Known Populations of Species of Special Concern

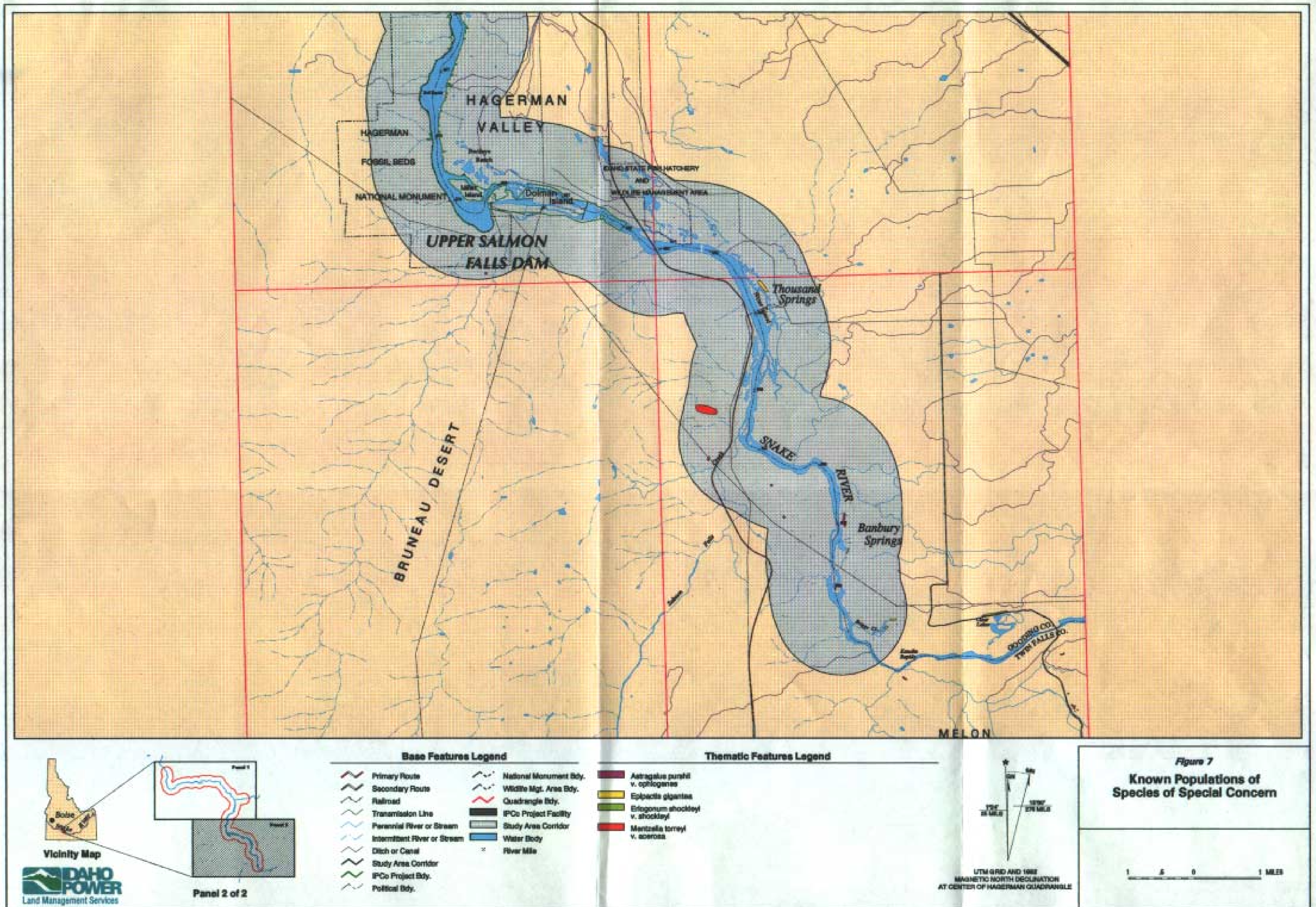


Figure 7

Known Populations of Species of Special Concern

Appendix 1. Definition of Federal and Idaho Native Plant Society rare species ranks (INPS 1994).

Federal Categories:

1 U.S. Fish & Wildlife Service has sufficient data to support listing as endangered or threatened.
2 Listing as endangered or threatened is possibly appropriate, but U.S. Fish & Wildlife Service lacks sufficient data to support such action.
3 Former candidate taxa (subcategories as indicated)
 3a Taxon is believed to be extinct
  3b Taxonomic status is in question
  3c Taxon is more widespread or abundant that previously believed, or is not subject to identifiable threats.

Federal Listing Priority:

Priority	Taxonomy	Threat: Magnitude	Threat: Immediacy
1	Monotypic genus	High	Imminent
2	Species		
3	Subspecies/Variety		
4	Monotypic genus		Non-imminent
5	Species		
6	Subspecies/Variety		
7	Monotypic genus	Low	Imminent
8	Species		
9	Subspecies/Variety		
10	Monotypic genus		Non-imminent
11	Species		
12	Subspecies/Variety		

Idaho Native Plant Society Ranks:

State Priority 1 A taxon in danger of becoming extinct or extirpated from Idaho in the foreseeable future if identifiable factors contributing to its decline continue to operate; these are taxa whose populations are present only at critically low levels or whose habitats have been degraded or depleted to a significant degree.

State Priority 2 A taxon likely to be classified as Priority 1 within the foreseeable future in Idaho, if factors contributing to its population decline or habitat degradation or loss continue.

Sensitive A taxon with small populations or localized distributions within Idaho that presently do not meet the criteria for classification as Priority 1 or 2, but whose populations and habitats may be jeopardized without active management or removal of threats.

Appendix 1. (Continued)

Monitor Taxa that are common within a limited range as well as those taxa which are uncommon, but have no identifiable threats (for example, certain alpine taxa).

Review Taxa which may be of conservation concern, but for which we have insufficient data upon which to base a recommendation regarding their appropriate classification.

Possibly Extirpated Taxa which are known in Idaho only from historical (pre-1920) records or are considered extirpated from the state.

Appendix 2. Biological information for each of the rare plant species thought to occur in the vicinity of the Hagerman Study Area.

Allium anceps is a spring-blooming onion, family Liliaceae, first discovered in Idaho in 1979 (DeBolt 1989). The species is widespread in Nevada, extending into adjacent states. It is reported to occupy heavy, barren soils of volcanic origin in swales and other low areas that hold standing water in the spring (DeBolt 1989) as well as on slopes (INPS 1993). Plants occur in association with ***Artemisia arbuscula*** and ***Eriogonum microthecum***. The known elevation range in Idaho is from 1400 to 1553 m (DeBolt 1989). Flowers are produced in May and early June.

Astragalus atratus var. ***inseptus*** is a Snake River Plain endemic that occurs in south-central Idaho at elevations above 1500 m (DeBolt and Rosentreter 1988, Smithman 1989). Habitats include rocky tablelands and plains with clay and clay-loam soils dominated by ***Artemisia tridentata*** ssp. ***wyomingensis***. Flowering occurs in May and June. In 1991, 34 populations had been reported. At that time, ***Astragalus atratus*** var. ***inseptus*** was recognized as a C2 rank by the Fish and Wildlife Service (USFWS) (INPS 1991).

Astragalus mulfordae occupies deep sandy soils at the northern and southern edge of the western Snake River Plain in Idaho and adjacent Malheur County, Oregon (INPS 1991). It is associated with ***Purshia tridentata*** steppe and salt-desert scrub communities (INPS 1991) and the ***Artemisia***-grassland life zone (DeBolt and Rosentreter 1988). The species ranges from 600 to 900 m in elevation and flowers from May through June. This species is very sensitive to grazing. The USFWS has designated ***Astragalus mulfordae*** as a C1 candidate species. A listing package has been prepared for review, but recent Conservation Agreements forged between BLM and USFWS have delayed listing. ***Astragalus mulfordae*** is among the candidate species included by the *Fund for Animals* vs. *U.S. Dept. of Interior* lawsuit[1].

Astragalus purshii var. ***ophiogenes*** is a small, tufted perennial endemic to the Snake River and its tributaries to the southwest (Barneby 1989). The genus ***Astragalus***, generally considered to be primitively mesophitic, is thought to be undergoing rapid adaptive radiation into arid environments. It is no surprise then, that variety ***ophiogenes*** is one of six varieties of ***A. purshii*** occurring in the Intermountain Region. The species is found widely scattered along the Snake River in southwest Idaho and into Malheur County, Oregon (Packard et al. 1980) (Figure 3*a*). It was first collected in 1893 at "Blue Lakes" on the Snake River Plain, presumably the Blue Lakes area near Twin Falls (Packard et al. 1979). Thirty-three populations in Idaho have been documented (INPS 1994*a*) (Figure 3*b*).

Astragalus purshii var. ***ophiogenes*** occupies both stable and active sandy and gravelly-sandy soils (Packard et al. 1980). While the variety appears to prefer specific soils, it does not appear to associate with specific vegetation communities. Its ability to reproduce under unstable soil conditions suggests it is well adapted to moderate disturbance (Packard et al. 1979). Packard et al. (1980) identified dam building and agricultural development as the principal threats to local

[1]The *Fund for Animals* lawsuit specifies that all species recognized as C1 by the USFWS will have a listing determination made by 1996.

Appendix 2. (Continued)

populations, but stated that "...because of its nearly continuous distribution with no major overall threats, the taxon is not in immediate danger."

Blepharidachne kingii is a low growing tufted, perennial grass (family: Poaceae) that occupies dry, gravelly soils dominated by ***Atriplex confertifolia*** and ***Artemisia tridentata*** (Cronquist et al. 1977). Flowering occurs from May to June. It is a widespread Great Basin endemic known possibly from one site in Owyhee County, Idaho. No other information is available about this species in Idaho.

Chaenactis cusickii, a small, annual composite, occurs in dry, open ***Atriplex*** sp.-***Artemisia tridentata*** ssp. ***wyomingensis*** habitats in southwestern Idaho and eastern Oregon. Most known populations occupy volcanic ash soils along the Idaho/Oregon border at elevations ranging from 700 to 1300 m (DeBolt and Rosentreter 1988). Blooms April to May.

Cleomella plocasperma is an annual member of the Capparidaceae family that is known from one historic site in Owyhee County, Idaho (INPS 1992). The species ranges from southeastern Oregon, Utah, Nevada and southern California. Preferred habitats are saline soils dominated by ***Distichlis stricta, Sarcobatus vermiculatus*** and other halophytic species. In Utah the species is found on heavy clay soils. Nevada populations occur on playas. Flowering occurs from May through July.

Cymopteris acaulis var. ***greeleyorum***, a perennial herb of the Apiaceae family, is only known from six sites in Idaho (INPS 1944). Sandy soils, ash (Succor Creek formation) and dense clays (Glenns Ferry formation) are the habitats preferred by the species. ***Artemisia tridentata*** ssp. ***Wyomingensis*** and ***Oryzopsis hymenoides-Leptodactylon pungens*** communities dominate the sites where the rare species occurs. ***Cymopteris acaulis*** var. ***greeleyorum*** is distributed from eastern Malheur County, Oregon to southwestern Idaho. Plants emerge soon after spring thaw and flower in March and April.

Dimersia howellii is an annual Composite that occurs on dry gravelly or rocky soils from low to mid-elevations in the mountains (DeBolt and Rosentreter 1988). The species occupies the open spaces between shrubs within ***Artemisia***-dominated communities. ***Dimersia howellii*** occurs in northeastern California and northwestern Nevada into Baker County, Oregon and western Owyhee County, Idaho (INPS 1993). Idaho is the northeastern edge of the species' range. Flowers occur from May to July.

Epipactis gigantea, a rhizomatous perennial, is a member of the Orchidaceae family in the tribe Neottieae. The genus ***Epipactis*** is distributed world wide with approximately 20 species occurring in the temperate regions of Eurasia (Luer 1975). Only one species, ***E. gigantea***, occurs in North America, in the western United States. ***Epipactis gigantea*** ranges from central Mexico northward throughout the western US and into southern British Columbia (Figure 4*a*). The species occurs only in cordilleran habitats (Brunton 1986). Over 40 sites in Idaho have documented populations of ***E. gigantea*** (Figure 4*b*). Two populations are believed to have been extirpated (Mancuso 1991). The habitat of ***E. gigantea*** is described as "...stream banks, lake

Appendix 2. (Continued)

margins, and around springs and seepage areas, especially near thermal waters, often in otherwise extremely desert regions..." (Hitchcock 1969). Luer (1975) noted the species appears to prefer thermal springs at the northern part of its range. Sheviak (New York State Museum, Biological Survey, *pers. comm.*, 27 Nov 1990) believes ***E. gigantea*** may be favored somewhat by limited disturbance. Flowers appear April - June. Orchids of this genus are typically insect pollinated (Messner 1980, van der Pijl and Dodson 1966). Syrphid flies are known to be the pollinator of ***Epipactis gigantea*** (Ross 1988, Messner 1980), as are common yellowjackets (Mantas 1993). Threats to the continued existence of the known populations of ***E. gigantea*** include ungulate grazing, construction of dams and reservoirs, and heavy recreational use of thermal hot springs (Spahr et al. 1991).

Eriogonum douglasii var. ***douglasii***, a perennial species of the Polygonaceae family, is found in ***Artemisia tridentata***-dominated communities, ***Juniperus*** spp. and ***Pinus ponderosa*** forests of central Washington, eastern Oregon and western Idaho (Hitchcock and Cronquist 1973). The species flowers May through July.

Eriogonum shockleyi var. ***packardae*** is a low-growing caespitose perennial of the Polygonaceae family recently described by Reveal (1989). It is distinguished from ***Eriogonum shockleyi*** var. ***shockleyi*** by having sessile clusters of involucres and a tight, compact growth form. Distinguishing between the two varieties can be difficult. Plants collected from the same site in two different years by two collectors were not identified to the same variety (INPS, Rare Plant Conference, 2/9/93). Both varieties are considered rare in Idaho (Table 1). Variety ***packardae*** is endemic to Idaho. Variety ***shockleyi*** has a similar distribution within Idaho, but extends south through Utah and Colorado into California, Arizona and New Mexico (Welsh et al. 1987). Reveal (1989) states variety ***shockleyi*** occurs to the south of variety ***packardae***. Current CDC data suggest significant overlap in distribution of the two varieties (Figure 5*b*). Preliminary data recently collected by the CDC bear this out (Moseley, CDC, *pers. comm.*, 14 Sept. 1995). The BLM and CDC will continue to clarify the distribution and taxonomy of the two varieties in 1995-1996 (Moseley, CDC, *pers. comm.*, 11 Jan. 1995). The species grows in lacustrine soils with a smooth, gravel surface (DeBolt and Rosentreter 1988). DeBolt (1989) identified no threats to known populations of variety ***shockleyi***.

Glyptopleura marginata is a small annual Composite that occupies sandy desert sites (DeBolt and Rosentreter 1988, Packard et al. 1979), including those with high gravel content, although sometimes occurring in loose ash or small basalt cinder soils (INPS 1992). It is a widespread species of the Great Basin, associated with desert shrub communities in southwestern Idaho, northeastern Oregon, Utah, Nevada and California from elevations 900 to 1500 m. Flowers appear May through June.

Lepidium davisii is a federal candidate species (C2) that occurs in southwestern Idaho and adjacent Oregon. The species is restricted to hard bottom playas that retain moisture in the spring (Packard et al. 1979) in ***Artemisia tridentata wyomingensis-Atriplex canescens/Poa secunda*** dominated sites ranging in elevation from 900 to 1500 m. Shrubs are generally absent from the playas, although ***Atriplex canescens*** and ***Artemisia cana*** occur occasionally. ***Lepidium***

Appendix 2. (Continued)

davisii flowers from April to (occasionally) August. With the recent drought, the frequency of invasion of playas by ***Salsola kali*** and ***Bromus tectorum*** has increased. A status survey for ***L. davisii*** will be completed in 1994.

Lepidium papilliferum is an Idaho endemic Cruciferae that occurs north of the Snake River in western Idaho, with one additional population in eastern Idaho near Pocatello. This perennial species tends to occur in the bare, natric soils between shrubs of the ***Artemisia***-steppe communities, including those dominated by ***Purshia tridentata*** growing on lacustrine soils (INPS 1991). It was known historically from Canyon County, but is now thought to be extinct there. The species blooms from May through June.

Mentzelia torreyi var. ***acerosa*** is a member of the Loasaceae family that typically occupies volcanic cinders and barren lacustrine soils (Debolt 1989, Packard et al. 1979). ***Artemisia tridentata*** ssp. ***wyomingensis*** and ***Atriplex confertifolia*** dominated communities are preferred habitat. Flowers appear in May and June for this perennial species. The distribution of the species includes Idaho (Davis 1952), Nevada (Kartesz 1987), California (Hickman 1993) and possibly Oregon (Hickman 1993) (Figure 6*a*). DeBolt and Rosentreter (1988) and DeBolt (1989) listed Mono County, California within the range of variety ***acerosa***. This may be incorrect as Munz (1977) reports only Modoc County, California for the species. Variety ***torreyi*** has been identified as the only variety of ***Mentzelia torreyi*** occurring in Nevada (Kartesz 1987) and as the likely variety in California (Packard ACI, *pers. comm.*, 3/9/94). If Packard is correct, the variety ***acerosa*** occurs only in Idaho (Packard ACI, *pers. comm.*) in the vicinity of the Snake River (Figure 6*b*). Little is known about the status of the species and its two varieties. The species is not recognized as rare outside of Idaho, although Packard suggested variety ***torreyi*** also has a restricted habitat elsewhere. DeBolt (1989) identified off-road vehicles, expanded agricultural development, and mining as possible threats to the species. This species was removed from the INPS rare plant list in 1995. It is included in this report because its distribution is centered on the Bliss Reservoir and Dike Reach. Development in these areas would likely put the species back on the rare plant list for Idaho.

Oxytheca dendroidea var. ***dendroidea*** is a small, annual member of the Polygonaceae family. It occupies sandy soils dominated by ***Stipa comata*** within the sagebrush deserts of southern Idaho (INPS 1994*a*). ***Oxytheca dendroidea*** var. ***dendroidea*** also occurs from central Washington, south to eastern Oregon, western Nevada and eastern California where it occurs in sagebrush-steppe and juniper woodland vegetation. Fourteen populations are known from Idaho, all of them on the Snake River Plain. Flowers appear from June through August.

Penstemon janishiae is a perennial herb of the Scrophulariaceae family that grows in lacustrine deposits and volcanic soils with high clay content (Cronquist et al. 1984). It ranges from northern California into southern Oregon, across Nevada and into southwest Idaho from elevations 1300 to 2250 m. It is associated with ***Artemisia tridentata, Juniperus*** spp. and pinyon-juniper woodland communities. Flowers appear in late May-June.

Appendix 2. (Continued)

Peteria thompsonae is a perennial of the Fabaceae family scattered widely, but discontinuously, over much of the Intermountain area. Only two populations are known from Idaho. The species occupies dry washes, clay flats and ridges, sandy flats, and talus at lower elevations. In Idaho, populations are associated with ***Salvia*** sp., ***Atriplex confertifolia*** and annual ***Eriogonum*** ssp. at elevations between 800 and 1000 m. Populations in Utah are at higher elevations, up to 1800 m, in pinyon-juniper and desert shrub communities. Flowers occur May through June.

Phacelia minutissima, a rare annual of the Hydrophyllaceae family, is known from two places in Idaho (INPS 1994*a*). The species' reported range includes Camas and Owyhee counties, Idaho; Elko County, Nevada; and the Wallowa Mountains of Oregon. The Oregon populations are thought to be extirpated and the Idaho populations have not been seen since 1972. The species typically occurs in plant communities dominated by ***Artemisia tridentata*** ssp. ***vaseyana*** and ***Populus tremuloides***. Flowering is limited to July (Eidemiller 1977*a*). The BLM will complete a status survey in Idaho in 1994.

Texosporium sancti-jacobi is a rare western lichen with a wide, but disjunct, distribution (McCune and Rosentreter 1992). The species is known to occur in southwestern Idaho, central Oregon, and western California. ***Texosporium sancti-jacobi*** is found in arid to semi-arid grasslands, shrublands, and savannas at elevations to 1000 m on a variety of soils. In Idaho the preferred dominant vegetation is ***Artemisia tridentata, A. arbuscula*** and ***Chrysothamnus nauseosus*** mixed with native bunchgrasses. Populations tend to occur on habitats that have not been disturbed recently, if at all.

Appendix 3. Standard reporting form provided by The Conservation Data Center, IDFG, for reporting rare plant populations.

SPECIAL PLANT SURVEY FORM

Site Name: ____________________ Date: ________ Source Code: ________

Quad Name: ____________________ Date: ________ Source Code: ________

Quad Code: ____________________ Date: ________ Source Code: ________

State: __________ County: __________ Date: ________ Source Code: ________

Field Quad Margin #: ____________________ Date: ________ Source Code: ________

Full extent of EO known and mapped? _____yes _____no

Precise locations of individuals or groups mapped on base map? _____yes _____no

BIOLOGY

Element Name: ____________________ Element Code: __________ Occ. #: ______

Phenology	Approx # Ramets		Approx # Genets	Population Area	Age Structure	Vigor
___In leaf				___1yd^2	___% Seedlings	___Very feeble
___In bud	___	1-10	___	___1-5 yd^2	___% Immature	___Feeble
___In flower	___	11-50	___	___5-10 yd^2	___% 1st year	___Normal
___Immature fruit	___	51-100	___	___10-100 yd^2	___% Mature (established)	___Vigorous
___Mature fruit	___	101-1000	___	___100 yd^2-2ac		___Exceptionally vigorous
___Seed dispersing	___	1001-10,000	___	___2 ac+	___% Senescent	
___Dormant	___	10K+	___	___est. area		
	___	est. #	___			

Comments on above: ____________________

Evidence of reproduction? ___yes ___no Explain: ____________________

Type of reproduction: ___sexual ___asexual ___both

Evidence of symbiotic or parasitic relationships? ___yes ___no Explain: ____________________

Evidence of disease, predation, etc. ___yes ___no Explain: ____________________

Success at Each Stage of Life Cycle

	good	fair	poor	none	uncertain
reproduction					
dispersal					
establishment					
maintenance					

Comments: ____________________

HABITAT

Aspect		Slope	Light	Topographic position	Moisture
___N	___NE	___Flat	___Open	___Crest	___Inundated (Hydric)
___E	___NW	___0-10	___partial	___Upper Slope	___Saturated(Wet-mesic)
___S	___SE	___10-35	___Filtered	___Mid-Slope	___Moist(Mesic)
___W	___SW	___35+	___shade	___Lower-Slope	___Dry-Mesic
		___Vertical		___Bottom	___Dry(Xeric)

Elevation: __________ ft to __________ ft

Cross section of topography (habitat)/include scale, direction, element position

HABITAT (continued)

Associated natural community/plant community: ______

Natural community form completed? ___yes ___no

Associated plant species: ______

______

Substrate/Soils: ______

Estimated # of acres of potential habitat in the immediate area: ______

IDENTIFICATION

Photograph taken? ___yes ___no

Specimen taken? ___yes ___no If yes, give coll. # and repository: ______

Do other members of this genus co-occur at this site? ___yes ___no If yes, complete below:

List: ______

Hybridization? ___yes ___no

Identification problems? ___yes ___no Explain: ______

CONSERVATION

Owner aware of EO? ___yes ___no ___unknown Owner protecting EO? ___yes ___no ___Unknown

Evidence of disturbance: ______

Threats to EO: ______

How large an area is needed to provide species survival here? ______

Explain: ______

______

Conservation/management needs: ______

______

Research needs: ______

Data security? ___yes ___no Explain: ______

SUMMARY

EO Quality: (ie, How representative is this occurrence? Consider the size and productivity of the population and the vitality and vigor of the individuals.)
A-Excellent B-Good C-Marginal D Poor

Comments: ______

EO Condition: (ie, Is the habitat supporting the EO pristine or degraded? Is there a potential for the habitat to recover from disturbances?)
A-Excellent B-Good C-Marginal D Poor

Comments: ______

EO Viability: (ie, What are the long-term prospects for continued existence of this occurrence at the indicated level of quality?)
A-Excellent B-Good C-Marginal D Poor

Comments: ______

EO Defensibility: (ie, Can this occurrence be protected from extrinsic human factors?)
A-Excellent B-Good C-Marginal D Poor

Comments: ______

EO Rank: (ie, a summary of all factors listed above) A B C D

Comments: ______

Appendix 4. Populations of rare plants encountered in the Hagerman Study Area, 1979-1994, listed in alphabetic order by species and river reach. Project and species codes are defined below. 1) indicates population was mapped in 1990 and individuals were counted, but no additional data were collected. All populations observed prior to 1990 were reported by the CDC as historic populations. There is no current information for those populations.

Species	Date observed (mmddyy)	Total number	Area (m^2)	Associated species	Project
Astragalus purshii ophiogenes	62690	242	100	CHNA CHVI	AJW
Astragalus purshii ophiogenes	62690	1849	2500	PUTR ARTR CHNA	AJW
Astragalus purshii ophiogenes	62690	13	20	PUTR ARTR CHNA	AJW
Astragalus purshii ophiogenes	62690	66	320	SAVE ATCA CHNA	AJW
Astragalus purshii ophiogenes	52990	100	1017	ARTR POSE	BL
Astragalus purshii ophiogenes	52594	8	50	ORHY STCO CHNA	BL
Astragalus purshii ophiogenes	50594	550	12206	CHVI ORHY SAKA	BLB
Astragalus purshii ophiogenes	50594	50	17	ORHY OEPA	BLB
Astragalus purshii ophiogenes	53180				BLB
Astragalus purshii ophiogenes	53180				BLB
Astragalus purshii ophiogenes	52788			ARTR/GRASS	BLB
Astragalus purshii ophiogenes	52788				LS
Astragalus purshii ophiogenes	61880	extensive			LS
Epipactis gigantea	62290	22	1	BEOC ELPA MIGU	AJW
Epipactis gigantea	80191	50	10	SAEX SOCA	LS
Epipactis gigantea	53190	150	4000	BEOC TORA	TS
Epipactis gigantea	71590	2000	8094	BEOC URDI MIGU	US
Eriogonum shockleyi shockleyi	52494	369	84	ARTR STPI CHVI	LS
Eriogonum shockleyi shockleyi?	40591	2000	8100	ARTR BRTE	MA
Eriogonum shockleyi shockleyi	81094	315	1215	PUTR STPI CHDO	LS
Mentzelia torreyi acerosa	51080				AJW
Mentzelia torreyi acerosa	61490	159	20000	PUTR PHHA CHDO	AJW
Mentzelia torreyi acerosa	62090	200	4049	PUTR ARTR ASPU	AJW
Mentzelia torreyi acerosa	61490	159	20000	PUTR PHHA CHDO	AJW
Mentzelia torreyi acerosa	1)	50			BL
Mentzelia torreyi acerosa	1)	50			BL
Mentzelia torreyi acerosa	1)	353			BL
Mentzelia torreyi acerosa	1)	215			BL

Appendix 4. (Continued)

Species	Date observed (mmddyy)	Total number	Area (m^2)	Associated species	Project
Mentzelia torreyi acerosa	1)	147			BL
Mentzelia torreyi acerosa	1)	3			BL
Mentzelia torreyi acerosa	1)	50			BL
Mentzelia torreyi acerosa	1)	120			BL
Mentzelia torreyi acerosa	1)	37			BL
Mentzelia torreyi acerosa	1)	6			BL
Mentzelia torreyi acerosa	1)	6			BL
Mentzelia torreyi acerosa	1)	57			BL
Mentzelia torreyi acerosa	1)	125			BL
Mentzelia torreyi acerosa	1)	184			BL
Mentzelia torreyi acerosa	1)	272			BL
Mentzelia torreyi acerosa	1)	75			BL
Mentzelia torreyi acerosa	1)	87			BL
Mentzelia torreyi acerosa	1)	2			BL
Mentzelia torreyi acerosa	41890	517		MEAL ASPU SIAL	BL
Mentzelia torreyi acerosa	62090	17	150	CHNA	BL
Mentzelia torreyi acerosa	62090	128	1500		BL
Mentzelia torreyi acerosa	62090	253	1200	CHNA PUTR	BL
Mentzelia torreyi acerosa	62090	96	290	PUTR CHNA	BL
Mentzelia torreyi acerosa	62090	975	8000	PUTR ARTR CHNA	BL
Mentzelia torreyi acerosa	62090	36	500	PUTR ARTR	BL
Mentzelia torreyi acerosa	62090	118	2500	PUTR CHNA ARTR	BL
Mentzelia torreyi acerosa	62090	1213	1600	PUTR CHNA ARTR	BL
Mentzelia torreyi acerosa	62090	1990	16000	PUTR CHNA ARTR	BL
Mentzelia torreyi acerosa	62090	45	35	PUTR ARTR	BL
Mentzelia torreyi acerosa	62090	1038	3000	PUTR CHNA ARTR	BL
Mentzelia torreyi acerosa	62090	84	2120	PUTR CHNA	BL
Mentzelia torreyi acerosa	62090	95	600	CHNA PUTR	BL
Mentzelia torreyi acerosa	62090	3225	6000	PUTR CHNA	BL
Mentzelia torreyi acerosa	62090	292	1800	ARTR PUTR CHNA	BL
Mentzelia torreyi acerosa	62090		150	PUTR CHNA BRTE	BL

Appendix 4. (Continued)

Species	Date observed (mmddyy)	Total number	Area (m^2)	Associated species	Project
Mentzelia torreyi acerosa	62090	26	190	ARTR PUTR CHNA	BL
Mentzelia torreyi acerosa	62090	151	330	ARTR PUTR CHNA	BL
Mentzelia torreyi acerosa	62190	45	300	CHNA PUTR	BL
Mentzelia torreyi acerosa	62190	27	45	CHNA PUTR	BL
Mentzelia torreyi acerosa	62190	169	1500	PUTR CHNA ARTR	BL
Mentzelia torreyi acerosa	62190	462	16000	PUTR CHNA ARTR	BL
Mentzelia torreyi acerosa	62190	313	4000	PUTR CHNA ATSP	BL
Mentzelia torreyi acerosa	62190	16		CHNA PUTR	BL
Mentzelia torreyi acerosa	62190	3520	10000	CHNA PUTR	BL
Mentzelia torreyi acerosa	62190	247	6000	PUTR CHNA ARTR	BL
Mentzelia torreyi acerosa	62190	1450	2000	PUTR CHNA ARTR	BL
Mentzelia torreyi acerosa	62190	1305	17500	CHNA PUTR	BL
Mentzelia torreyi acerosa	62190	460	2250	CHNA PUTR	BL
Mentzelia torreyi acerosa	62190	979	45000	CHNA PUTR	BL
Mentzelia torreyi acerosa	62190	645	2000	CHNA PUTR	BL
Mentzelia torreyi acerosa	62290	393	500	PUTR CHNA ARTR	BL
Mentzelia torreyi acerosa	62290	646	14000	PUTR CHNA ARTR	BL
Mentzelia torreyi acerosa	1)	350			BLB
Mentzelia torreyi acerosa	1)	10			BLB
Mentzelia torreyi acerosa	1)	54			BLB
Mentzelia torreyi acerosa	1)	20			BLB
Mentzelia torreyi acerosa	1)	375			BLB
Mentzelia torreyi acerosa	1)	20			BLB
Mentzelia torreyi acerosa	1)	69		CHNA PUTR PHHA	BLB
Mentzelia torreyi acerosa	52494	460	8360	STCO ORHY CHNA	BLB
Mentzelia torreyi acerosa	52594	575	1338	ASNU PHHA ATCA	BLB
Mentzelia torreyi acerosa	52594	350	7500	ASNU PUTR CHNA	BLB
Mentzelia torreyi acerosa	52594	160	1338	CHDO ASPU CHNA	BLB
Mentzelia torreyi acerosa	52594	140		CHDO ASNU PUTR	BLB
Mentzelia torreyi acerosa	52694	1375		CHNA PUTR PHHA	BLB
Mentzelia torreyi acerosa	52694	167		ASPU CHDO SAKA	BLB

Appendix 4. (Continued)

Species	Date observed (mmddyy)	Total number	Area (m²)	Associated species	Project
Mentzelia torreyi acerosa	61791	1500	20000		BLB
Mentzelia torreyi acerosa	61991	2450	40000	ARTR/GRASS	BLB
Mentzelia torreyi acerosa	61991	4200	24000	ARTR/GRASS	BLB
Mentzelia torreyi acerosa	62090	275	500	CHNA PUTR	BLB
Mentzelia torreyi acerosa	62094	242	2400	CHNA	BLB
Mentzelia torreyi acerosa	62690	4200	24000	ARTR CHNA BRTE	BLB
Mentzelia torreyi acerosa	52494	6	8	STPI PUTR LEPU	LS
Mentzelia torreyi acerosa	81194	50	1215	PUTR STPI CHDO	LS
Mentzelia torreyi acerosa	81194	59	10	ARTR CHNA CHVI	LS
Mentzelia torreyi acerosa	52079				TS
Mentzelia torreyi acerosa	52079			ARTR LAPU	TS
Mentzelia torreyi acerosa	51590	300	80972	PUTR ATCO ORHY	TS
Mentzelia torreyi acerosa	62290	610	45000	CHNA ARTR ATSP	TS
Mentzelia torreyi acerosa	51593	25	4049	TETRA ATSP ARSP	TS
Penstemon janishiae	51180				BLB
Penstemon janishiae	xxxx93				BLB
Penstemon janishiae	xxxx94?				BLB

Project codes

AJW	Wiley Reach
TS	Thousand Springs Reach
BL	Bliss Reservoir
BLB	Dike Reach
LS	Lower Salmon Falls Reservoir
MA	Malad River
US	Upper Salmon Falls Reservoir

Associated species codes

ASNU	*Astragalus nudisiliquus*
ASPU	*Astragalus purshii*
ARTR	*Artemisia tridentata*
ATCA	*Atriplex canescens*
ATSP	*Atriplex spinosa*
BEER	*Berula erecta*
BEOC	*Betula occidentalis*
BRTE	*Bromus tectorum*
CHDO	*Chaenactis douglasii*
CHVI	*Chrysothamnus viscidiflorus*
CHNA	*Chrysothamnus nauseosus*
DIFU	*Dipsacus fullonum*
ELPA	*Eleocharis palustris*
EUOC	*Euthamia occidentalis*
GRASS	unidentified grass sp.
LEPU	*Leptodactylon pungens*
LEMN	*Lemna* spp.
MEAL	*Mentzelia albicaulis*
MIGU	*Mimulus gutattus*
OEPA	*Oenothera pallida*
ORHY	*Oryzopsis hymenoides*
PEAC	*Penstemon acuminatus*

Appendix 4. (Continued)

PHAR	*Phalaris arundinaceae*
PHHA	*Phacelia hastata*
PUTR	*Purshia tridentata*
SAEX	*Salix exigua*
SAKA	*Salsola kali*
SAVE	*Sarcobatus vermiculatus*
SCAC	*Scirpus acutus*
SCAM	*Scirpus americanus*
SIAL	*Sisymbrium altissimum*
SOCA	*Solidago canadensis*
SODU	*Solanum dulcamara*
STPI	*Stanleya pinnata*
STCO	*Stipa comata*
TORA	*Toxicodendron radicans*
TETRA	*Tetradymia* sp.
URDI	*Urtica dioica*
XAST	*Xanthium strumarium*